ICTA'07, April 12-14, Hammamet, Tunisia

Multimedia Distance Learning Environment

Khadidja Harbouche
Department of Computer Science,
Engineering science faculty
University Ferhat Abbes of Setif, Algeria
harbouchek@yahoo.fr

Mahieddine Djoudi
Laboratoire SIC et Equipe IRMA
UFR Sciences SP2MI, Université de Poitiers
Téléport 2, Boulevard Marie et Pierre Curie,
BP 30179, 86962 Futuroscope Chasseneuil
Cedex, France
mahieddine.djoudi@univ-poitiers.fr

Abstract

We present in this paper a multimedia distance-learning environment. The multimedia supports accessibility and the access to the knowledge for all. Our aim is to make the training system truly accessible by the disabled persons, according to three principles: knowledge availability, users' extensive and personalized assistance and system flexibility. The incorporation of computer science and telecommunications has profoundly changed the implementation problems of learning systems. A distance learning environment is an individual and customizable implement allowing every user to have access, in a simple way, and across networks, to the communication tools, services and digital means, which he needs for his activity.The implementation of such environment is becoming possible by the development of the Internet / Intranet and the appearance of Multi Agents Systems "MAS". In our model, human users and artificial agents carry out tasks in the disabled learners' service. We define the internal structure of our kernel supposed to work within Internet/Intranet settings. It is claimed that the agent-based technology is a suitable approach for two main reasons: agents are a natural metaphor of human acts, and the learning systems are usually complex.

1. Introduction

For the disabled persons, the equal rights to education and work pass by positive actions: it is not enough that this right is proclaimed it must especially be guaranteed in practice [10].

The disabled people access to the training hits to some obstacles, such as: the equipment, insufficient means of displacement, geographical distances, climate, rhythms of lesson are not diversified according to individual constraints, and the media used are not usable by all.
With the explosion of Internet and the development of the web, the knowledge constantly updated, goes towards the learners especially those that have a particular rhythm of life, irregular because of tiredness, functional rehabilitation, etc; or those who have multiple sclerosis.

2. Knowledge availability

At its most basic level, distance education takes place when a teacher and student(s) are separated by physical distance, and technology (*i.e.,* voice, video, data, and print), often in concert with face-to-face communication and is used to bridge the instructional gap. These types of programs can provide adults with a second chance at a college education, reach those disadvantaged by limited time, distance or physical disability, and update the knowledge base of workers at their places of employment [1], [16].

The statement that there are not almost activities in e-learning for the disabled people in the Arab world and in more particular in Algeria because of, perhaps, the fact that the e-learning experiments in these countries in progress are in a limited number in addition to the miss of coordination, pushed us to think a manner to enable the disabled persons.

Our objective is to create necessary resources to make of a distance-learning situation an acceptable equivalent of face-to-face situation, while authorizing

more flexibility compared to the space and time constraints. Thus, instead the learner reaches the knowledge by himself, it is the knowledge constantly updated, which goes towards the learners especially, but not limited to, the paraplegic ones.

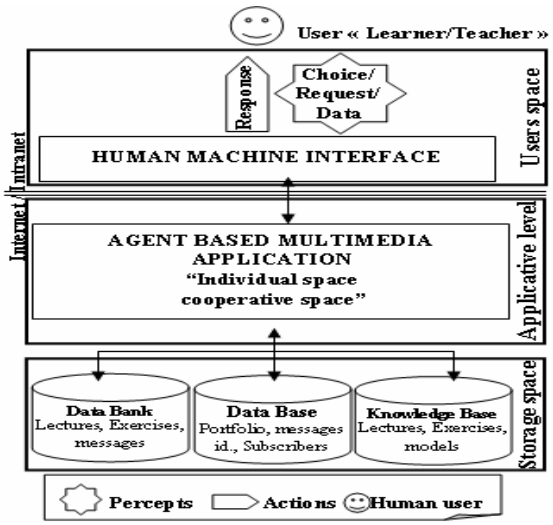

Figure 1. System architecture

In the following sections, we will present the tools, deployed via the web, which should enable us to make possible the accessibility to knowledge. These tools help to break the insulation of the disabled persons thanks to communication means, to share knowledge with other learners, to adapt the rhythm of training to the will and the availability of the disabled people and, therefore, to enjoy the same working conditions as in face-to-face situation.

3. Multimedia and communication tools

We advocate the deployment of the hypermedia and the web services to fill some physical disabilities by other skills. A wide range of technological multi media options is available to the distance educator. These fall into four major categories [7]:

Voice - Instructional audio tools include the interactive technologies of telephone, audio conferencing, and short-wave radio. Passive (i.e., one-way) audio tools include tapes and radio.

Video - Instructional video tools include still images such as slides, pre-produced moving images, and real-time moving images combined with audio conferencing (one-way or two-way video with two-way audio).

Data - Computers send and receive information electronically. For this reason, the term "data" is used to describe this broad category of instructional tools.

Print - is a foundational element of distance education programs and the basis from which all other delivery systems have evolved. Various print formats are available including: study guides, course syllabi, and case studies.

The available communication tools are either asynchronous (*e.g.* email, fax, newsgroups, newspapers) or synchronous (*e.g.* virtual classroom, telephone, videoconference, shared on-line document, «chat»). The communication can be private if it is done between an individual I and one individual J, or public if it is done between an individual I with a group or between two groups. When we consider groups, those «for our environment» are necessarily closed the list of names of the individuals which compose them is known, and well identified.

Table 1. Communication tools

Model	Tool	Interactivity degree
I ⇔ I	**e-mail** - asynchronous- **Chat** - synchronous-	Relatively average High
I ⇔Group	**Visio-conference** **Forum**	Very high Relatively high
Closed groups Gr1 ⇔ Gr2	**Forum** **Visioconference**	Very high Very high

4. Intranet / Web design

The Internet/Intranet/web features focus on four facilities offered to the student namely reading, writing, speaking and listening either synchronously or not. The basic elements of the web site are composed of the following elements:

- Mail and address book allowing all the actors to contact each other.
- Videoconference for both synchronous and asynchronous modes.
- Courses as the written electronic version of classical courses using XML facilities and multi media support.
- Evaluation tools representing the different ways of student testing such as MCQs (multiple choice questions), mini or full projects, assisted or not assisted exercises/problems with gradual difficulty (simple, intermediate, complex), classical exercises / problems. The human tests grading is only required

in this last case, otherwise it is completely automatic with instructor supervision.

- The portfolio or the schoolbag is a log, a process, a step of learning and a formative valuation which helps, on the one hand, learners to learn and to progress [5][6][7], and on the other hand, the teacher to take measures to help the learner to ameliorate his learning [4][11][13]. Among, the types of pedagogy which melt the practice of the portfolio, we have the cognitivism and constructivism [17]. We have three main kinds of electronic schoolbags: Learning portfolio, which, contains jobs accomplished by the learner; the presentation/communication portfolio, which, contains the productions that the learner likes to keep while annotating his opinion over to other pedagogic actors; and the valuation portfolio, which contains evaluations and judgments carried by the teacher on chosen jobs accomplished by the learner.

Other tools are also required:

- Access control and authentication tool is required from faculty and students.
- Registration tool allows the administration to register a given student in requested courses (e.g. level, option).

5. Artificial assistance

The teacher has multiple and diverse tasks to assume, moreover he has to follow-up and communicate synchronously with learners. On the other hand, disabled persons have a special way of life preventing them to take a course in a regular and assiduous way. For these reasons, and since the teacher cannot be ubiquitous, and he is exceeded and overloaded by his tasks, some situations require artificial assistance to bring support and accompaniment to the learner, such as:

- Automatic correction of the MCQs "alternate (yes / not), elementary (only one right answer per question), simple (one or more right answers by question)";
- Learner exercises resolution assistance and orientation followed upon the request of the learner or the thinking time collapsing or a learner erroneous answer;
- Learner course maieutic explanation
- Management of the meeting time: taking account of the availability of the various actors, ensuring the communication between members, animating the dialogue, taking care and motivating the learner left apart from the interaction.
- Fitting the various interfaces to the disabled person's profile.
- Course management personalized.

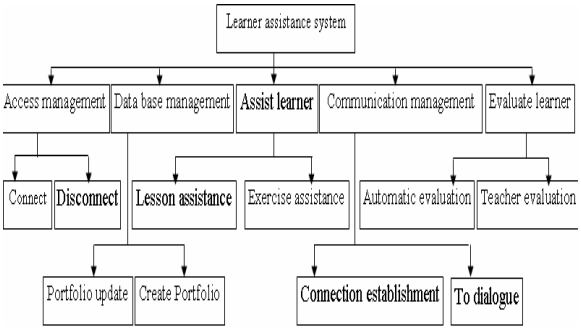

Figure 2. Goal hierarchy diagram

5.1. Why agents?

An agent is widely understood to be a software entity situated in an environment, autonomous, reactive to changes in its environment, proactive in its pursuit of goals and social [9] [12].

Whereas some characteristics cannot be used as determining factors since, they are grey shades of a scale that encompasses both objects and agents.

The Multi Agent Systems adapt well to the design of our learning environment because the distance learning systems are open, dynamic and complex; agents are a natural metaphor of human acts and thus can assist the learners any time.

5.2. An alternative representation of use cases

We will use the following generic representation: actor (use case1, … use case n) meaning that the actor has an access to the system functions described by use case1 to use case n.

Based on this simplifying notation, and with reference to the actors described above, our system posses the following key use cases:

- Learner (access to training contents, search in the index, undertake applications, communicate, resolve exercises, annotate lesson, collaborate, cooperate).

5.3. The artificial agents

These agents have to communicate with the users "actors", make decisions, assist learners, help teachers, consider and modify the users Database "DB", access to the Knowledge Base "BK"…

Two important metrics of the software engineering: cohesion and coupling enabled us to identify and structure our agents according to the MASE [2] "Multi Agent System Engineering" methodology. These agents are:

- Learner Interface: This agent has to get, announce and return available information relating to the user

needs “Percepts: request and choice; actions: response and sending information”.

- The assistant “Companion”: It has to assist the learner, to orientate him in the resolution of the assisted exercises, to answer his questions directly and dialogue with him.
- The collaborator: It notices and diagnoses correlations between learners of the same group. To re-aim the group in a productive direction and pay attention to the members left except correlation and save the group session work.
- Communication: Manage synchronous/ asynchronous, confidential/public communications, between the different dealers.
- Evaluator: It evaluates MCQs, returns result instantly and updates the learner valuation file.
- Cooperation: It facilitates co-operative work between working groups.
- Scheduler: It finds suitable meeting time according to the groups chiefs availability, schedules meetings according to a preset or improvised planning “programs, cancels or defers”, and warns the absents.
- Supplier: It performs access to the Database.
- The advisor: communicate and makes available information relating to the knowledge.
- Learner diagnosis: It observes and diagnoses the intentional and emotional methods of the learner. It analyzes the intentional methods “capacity, knowledge, to want, to believe, and to have" and emotional "pleasure, confidence, benevolence" then draws up a behavioural and epistemological profile of the learner to bring adequate human and/or artificial assistance.
- Expert: Allows the access and the exploration of the knowledge base.

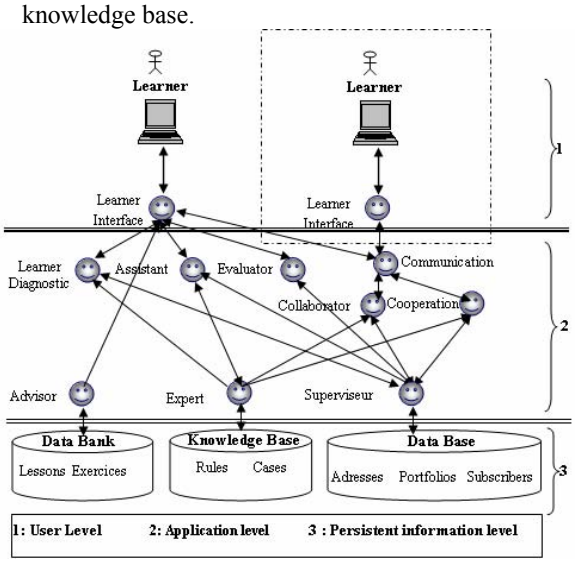

Figure 3. Human/artificial agents’ cooperation

5.4. The interaction protocol sample

The following interaction protocol describes the various steps allowing a person with a disability to have a tailored learning (Just in time/Just enough/Just for the physical disability).

As soon as a learner is connected to the application via Internet “by specifying a user name and a password”, a Learner interface agent is created to supervise his activities. The learner interface agent collects information relating to the learner profile **(1)** and sends them to the diagnosis agent **(2).** The learner interface agent requests the needed pedagogic content to the advisor agent **(3).** The advisor agent asks the supplier agent to extract information "lectures or exercises" from the learner portfolio and necessary information concerning the learner profiles **(4).** It requires then the assistance of the expert agent, which has access to the KB to adapt the formation to the learner profile **(5)**. Finally it communicates, to the interface agent, the dynamically built web page of the available information adapted to the learner features **(6)** information are, thus, showed at the learner screen **(7).** The diagnosis agent analyses the information relating to the learner profile and asks the supplier agent to update the learner profile **(3’)**

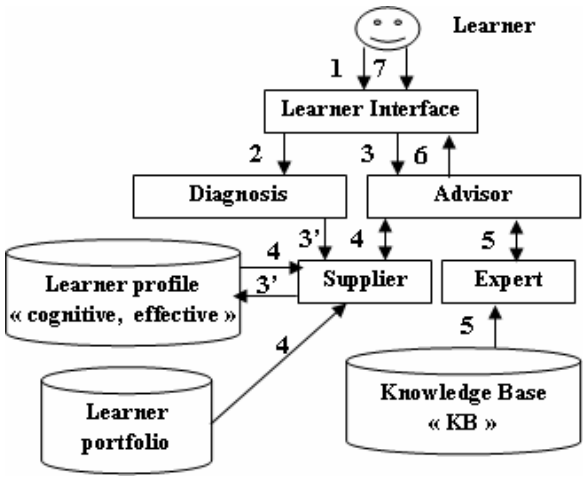

Figure 4. Interaction protocol sample

6. Human/Agents relationships

Our tool must take into account the problems underlined by the various forms of distance learning, namely: the sociological insulation of the learner, the loss of motivation and the autonomisation of the disabled learner.

The acquisition of new knowledge is done within the framework of an interaction between the learner and a system "embarking" the knowledge to be acquired.

We understand by "system embarking the knowledge" a human (a teacher, or a co-learner) or a device in which this knowledge is used in a multimedia form [3] [14] [15].

Table 2. Bipolar interactions

Relation	Wording	Description
Teacher-learner	To form	It favours the dual relation Teacher-learner
Teacher-Knowledge	To teach	Traditional transmission of knowledge
Teacher-Group	To facilitate	Interaction of the teacher with the group (seen like an entity). The teacher must listen, clarify, prepare, contribute to the decision-making, sow the feeling of membership, simplify, and coordinate, …
Learner-Knowledge	To learn	Reflexive phase of the learner with the knowledge
Learner-Group	To participate	Group communication and coordination, and members interdependence
Group-Knowledge	To share	To integrate, exchange and distribute the knowledge " mutual learning"
Teacher-Agents	To help	Agent can substitute, help and collaborate with the teacher. It can be delegated certain missions or to sub-contract part of the work of the teacher.
Learner-Agents	To assist	The agent can assist the learner during exercises resolution session, direct him and evaluate MCQs
Group-Agents	To coordinate	Schedule task's actions and order the parallel tasks "meeting time »
Agent-Agent	To coorporate	An agent assigns the tasks that it does not know how to solve to qualified agents. It interrupts its plans to help the others; and integrates the information of other agents.

Knowledge makes sense only if it is socialized, likely to allow the exchange between human. The processes of expression, clarification, formulation are essential on the cognitive plan [8].
The table (table 2) describes ten bipolar relations disengaged from any training system and the proposed system in this paper particularly:
The interaction with the others will allow the disabled learner to better assimilate, break the obstacles and the insulation that he lives, to be integrated, to exchange his ideas with other learners …

7. Conclusion

The integration of CITs "Communication and Information Technologies", even if it costs, makes it possible to meet the needs of disabled persons by adapting the training to their own needs "physical disability kind, rhythm of training …"

The vision of the Web of tomorrow, a web open on the world, on all the human ones, will allow a better dealt with the disabled people. The knowledge will not be limited any more to learners "not disabled" but on the contrary, they will have the possibilities to recover theirs rights. Our aim is to develop a system and implement on-line resources and tools to make them available and adaptable to individual behaviour of the end-user by providing extensive help and personalized assistance. The deployment of a Multi Agents Systems "MAS" is advantageous for us. It meets the need for autonomy and allows the artificial components in collaboration with the human actors to answer dynamically the changing circumstances while trying to achieve the teaching goals of the learners.

8. References

[1] Bartolome A. R., and J.D.M Underwood, *"*EAD : Introduction*"*, www.teletreball.com/frances/evaluations.html, 1998.

[2] DeLoach S.A., "Analysis and Design using MaSE and agentTool", *12th Midwest artificial Intelligence and Cognitive Science conference (MAICS 2001),* Miami University, Oxford, Ohio, March 31 - April 1 2001.

[3] Gerbault J., and Portine H., "Environnement virtuel en contextes collaboratifs et non collaboratifs préalables à une analyse des stratégies d'élucidations du sens", *Colloques Usages des Nouvelles Technologies et Enseignement des Langues Etrangères UNTELE*, UTC, France, Oct. 2001, vol. 2, pp. 23-30

[4] Goupil G., *Portfolio et dossiers d'apprentissage*, Mc GRAW Hill, 1998.

[5] Harbouche K., and Djoudi M., “Apprentissage coopératif à base d’agents sur le Web“, *Journées d’étude sur les Technologies de l’Information et de la Communication (JeTIC)*, Bechar, ALGERIA, April 15-17 2006.

[6] Harbouche K., and Djoudi M., “Environnement numérique de travail à base d’agents“, *Conférence Internationale sur l’Informatique et ses Applications (CIIA06)*, Saida, ALGERIA, May 14-16 2006.

[7] Harbouche K., and Hamdi-Cherif A., “An object-oriented design for a distance education platform”, Paper presented at *International E-learning Symposium*, Dubai, United Arab Emirates, 12-13 May 2002.

[8] Jhonston R., “ Distance learning medium or message“, *Journal of Further and Higher education*, 1997.

[9] Luck M., Mc Burney P., and Preist C., “Agent technology: Enabling next generation computing“, Agent LinkII, 2003.

[10] Maurin J.C., and Novossibirsk, "Quel système de formation pour l’accès des personnes handicapées à la qualification et à l’emploi ? ", July 2001.

[11] Muller F., “Vers une évaluation personnalisée“, in *Apprendre, revue Sciences Humaines*, octobre 1999, n°98, p.30.

[12] Padgham L., and Winikoff M., *Prometheus: A Practical Agent-Oriented Methodology*, In Henderson B. & Giorgini P. (Ed), Agent-oriented methodologies. Idea Group Publishing (IGP), ISBN 1-59140-587-4, 2005.

[13]. Perrenoud Ph., “Pour une approche pragmatique de l'évaluation formative“, in *Mesure et évaluation*, vol. 13, n°4, 1991.

[14] Romero M., “*Apprentissage dans une EIAH à l’aide des outils de modélisation de connaissances*“, M1. LIUM. Lemans, Mars 2003, www.margarida-Romero.com/cursus/dea_chm_ie/content/ic/romero_m1.pdf

[15] Tchounikine P., *Pour une ingénierie des Environnements Numériques Informatiques pour l'Apprentissage Humain*, Cépadués –Edition 2002.

[16] Vivet M., "Les dispositifs technologiques pour l’EAD", www.bf.resafad.org/coursdu/m3/m3.3.1, 1999.

[17] Weindenfeld G., “Typologies du e-learning“, Acts of *l'université d'été –La Formation Continue Ouverte et à Distance*, Poitiers, France, 2002.